

## Claims

- 1) Nucleic acid sequence encoding a 9 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes  
5 an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 5
- 2) Nucleic acid sequence encoding a 14 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes  
10 an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 3
- 3) Nucleic acid sequence encoding a 28 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes  
15 an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 1
- 4) Nucleic acid sequence encoding a 47 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes  
20 an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 7
- 5) Nucleic acid sequence encoding a *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes  
25 an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 9
- 6) Nucleic acid sequence encoding a *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes  
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- an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 11
- 5        7) Nucleic acid sequence encoding a *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 13
- 10       8) Nucleic acid sequence encoding a *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 15
- 15       9) Nucleic acid sequence encoding a *Mycobacterium avium* subspecies *paratuberculosis* protein or a part of said nucleic acid sequence that encodes an immunogenic fragment of said protein, said nucleic acid sequence or said part thereof having at least 85%, preferably 90 %, more preferably 95 % homology with the nucleic acid sequence of the *Mycobacterium avium* subspecies *paratuberculosis* protein gene as depicted in SEQ ID NO: 17
- 20       10) Nucleic acid sequence encoding a 60 kD *Mycobacterium avium* subspecies *paratuberculosis* protein having a pI of 5.60-6.15 or a part of said nucleic acid sequence that encodes an immunogenic fragment of said protein.
- 25       11) Nucleic acid sequence encoding a 33 kD *Mycobacterium avium* subspecies *paratuberculosis* protein having a pI of 4.20-4.75 or a part of said nucleic acid sequence that encodes an immunogenic fragment of said protein.
- 12) DNA fragment comprising a nucleic acid sequence according to claim 1-11.
- 30       13) Recombinant DNA molecule comprising a nucleic acid sequence according to claim 1-11 or a DNA fragment according to claim 12, under the control of a functionally linked promoter.

- 14) Live recombinant carrier comprising a nucleic acid sequence according to claim 1-11, a DNA fragment according to claim 12 or a recombinant DNA molecule according to claim 13.
- 5 15) Host cell comprising a nucleic acid sequence according to claim 1-11, a DNA fragment according to claim 12, a recombinant DNA molecule according to claim 13 or a live recombinant carrier according to claim 14.
- 10 16) A 9 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 %to the amino acid sequence as depicted in SEQ ID NO: 6.
- 15 17) A 14 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 %to the amino acid sequence as depicted in SEQ ID NO: 4.
- 20 18) A 28 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 %to the amino acid sequence as depicted in SEQ ID NO: 2.
- 25 19) A 47 kD *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 %to the amino acid sequence as depicted in SEQ ID NO: 8.
- 30 20) A *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 %to the amino acid sequence as depicted in SEQ ID NO: 10.
- 21) A *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%,

preferably 92 %, more preferably 94 % to the amino acid sequence as depicted in SEQ ID NO: 12.

- 5 22) A *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 % to the amino acid sequence as depicted in SEQ ID NO: 14.
- 10 23) A *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 % to the amino acid sequence as depicted in SEQ ID NO: 16.
- 15 24) A *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, characterized in that said protein or immunogenic fragment thereof has a sequence homology of at least 90%, preferably 92 %, more preferably 94 % to the amino acid sequence as depicted in SEQ ID NO: 18.
- 20 25) A *Mycobacterium avium* subspecies *paratuberculosis* 60 kD protein having a pI of 5.60-6.15 or an immunogenic fragment of said protein.
- 20 26) A *Mycobacterium avium* subspecies *paratuberculosis* 33 kD protein having a pI of 4.20-4.75 or an immunogenic fragment of said protein.
- 25 27) A *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment of said protein, according to claims 16-26, characterized in that said protein or immunogenic fragment is encoded by a nucleic acid sequence according to claim 1-11.
- 25 28) An *Mycobacterium avium* subspecies *paratuberculosis* protein or an immunogenic fragment thereof, according to claims 16-26, or a nucleic acid sequence according to claims 1-11, for use in a vaccine.
- 30 29) Use of a nucleic acid sequence according to claim 1-11, a DNA fragment according to claim 12, a recombinant DNA molecule according to claim 13, a live recombinant carrier according to claim 14, a host cell according to claim 15 or a protein according to claims 16-26 or an immunogenic fragment thereof for the manufacturing of a vaccine for combating *Mycobacterium avium* subspecies *paratuberculosis* infection.

- 30) Vaccine for combating *Mycobacterium avium* subspecies *paratuberculosis* infection, characterized in that said vaccine comprises at least one *Mycobacterium avium* subspecies *paratuberculosis* protein according to claims 16-26 or an immunogenic fragment of said protein and a pharmaceutically acceptable carrier.
- 31) Vaccine for combating *Mycobacterium avium* subspecies *paratuberculosis* infection, characterized in that said vaccine comprises a nucleic acid sequence according to claims 1-11, a DNA fragment according to claim 12, a recombinant DNA molecule according to claim 13, a live recombinant carrier according to claim 14 or a host cell according to claim 15 and a pharmaceutically acceptable carrier.
- 32) Vaccine for combating *Mycobacterium avium* subspecies *paratuberculosis* infection, characterized in that said vaccine comprises antibodies against a protein according to claims 16-26 or an immunogenic fragment of said protein and a pharmaceutically acceptable carrier.
- 33) Vaccine according to claims 30-32, characterized in that said vaccine comprises an adjuvant.
- 34) Vaccine according to claims 30-33, characterized in that said vaccine comprises an additional antigen derived from a virus or micro-organism pathogenic to cattle, an antibody against said antigen or genetic information encoding said antigen.
- 35) Vaccine according to claim 34, characterized in that said virus or micro-organism pathogenic to cattle is selected from the group of Bovine Herpesvirus, bovine Viral Diarrhoea virus, Parainfluenza type 3 virus, Bovine Paramyxovirus, Foot and Mouth Disease virus, *Pasteurella haemolytica*, Bovine Respiratory Syncytial Virus, *Theileria* sp., *Babesia* sp., *Trypanosoma* species, *Anaplasma* sp., *Neospora caninum*, *Staphylococcus aureus*, *Streptococcus agalactiae*, *Mycoplasma*, *E. coli*, *Enterobacter*, *Klebsiella*, *Citrobacter* and *Streptococcus dysgalactiae*.
- 36) Method for the preparation of a vaccine according to claims 30-35, said method comprising the admixing of a nucleic acid sequence according to claims 1-11, a DNA fragment according to claim 12, a recombinant DNA molecule according to claim 13, a live recombinant carrier according to claim 14, a host cell according to claim 15, a protein according to claims 16-26 or

antibodies against a protein according to claims 16-26, and a pharmaceutically acceptable carrier.

- 5 37) A diagnostic kit comprising suitable detection means and a nucleic acid sequence according to claims 1-11 or a primer thereof, a protein according to claims 16-26 or an immunogenic fragment thereof, or antibodies that are reactive with a protein according to claims 16-26.